



Challenges associated with projecting urbanization-induced heat-related mortality

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Abstract:

Maricopa County, Arizona, anchor to the fastest growing megapolitan area in the United States, is located in a hot desert climate where extreme temperatures are associated with elevated risk of mortality. Continued urbanization in the region will impact atmospheric temperatures and, as a result, potentially affect human health. We aimed to quantify the number of excess deaths attributable to heat in Maricopa County based on three future urbanization and adaptation scenarios and multiple exposure variables. Two scenarios (low and high growth projections) represent the maximum possible uncertainty range associated with urbanization in central Arizona, and a third represents the adaptation of high-albedo cool roof technology. Using a Poisson regression model, we related temperature to mortality using data spanning 1983-2007. Regional climate model simulations based on 2050-projected urbanization scenarios for Maricopa County generated distributions of temperature change, and from these predicted changes future excess heat-related mortality was estimated. Subject to urbanization scenario and exposure variable utilized, projections of heat-related mortality ranged from a decrease of 46 deaths per year (-95%) to an increase of 339 deaths per year (+359%). Projections based on minimum temperature showed the greatest increase for all expansion and adaptation scenarios and were substantially higher than those for daily mean temperature. Projections based on maximum temperature were largely associated with declining mortality. Low-growth and adaptation scenarios led to the smallest increase in predicted heat-related mortality based on mean temperature projections. Use of only one exposure variable to project future heat-related deaths may therefore be misrepresentative in terms of direction of change and magnitude of effects. Because urbanization-induced impacts can vary across the diurnal cycle, projections of heat-related health outcomes that do not consider place-based, time-varying urban heat island effects are neglecting essential elements for policy relevant decision-making.

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Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Other Climate Scenario

Other Climate Scenario: SunCorrHi; SunCorrLo

Early Warning System:

Climate Change and Human Health Literature Portal

resource focus on systems used to warn populations of high temperatures, extreme weather, or other elements of climate change to prevent harm to health

A focus of content

Exposure :

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Temperature

Temperature: Extreme Heat, Fluctuations

Geographic Feature:

resource focuses on specific type of geography

Desert, Urban

Geographic Location:

resource focuses on specific location

United States

Health Impact:

specification of health effect or disease related to climate change exposure

Injury, Morbidity/Mortality

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology:

type of model used or methodology development is a focus of resource

Outcome Change Prediction

Resource Type:

format or standard characteristic of resource

Research Article

Timescale:

time period studied

Medium-Term (10-50 years)

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content